WHAT IS CLAIMED:

- 1. A method for preparing particles of a platinum metal element on a carbon substrate that comprises the steps of:
- (a) contacting a carbon substrate with an aqueous solution of a dissolved platinum metal element complex present at a pH value of about 2 to about 4 where said platinum metal element is present as an anionic complex and at a pH value of about 10.5 to about 13 where said platinum metal element is present as a cationic complex, whereby use of a carbon substrate having a higher PZC value at said low pH values or a carbon substrate having a lower PZC at said high pH values provides greater adsorption of said platinum metal element complex than the reverse usage;
- (b) maintaining said contact at said pH value for a time period sufficient for said platinum metal element complex to adsorb onto said substrate to form a platinum metal complex-loaded substrate;
- (c) heating said platinum metal complexloaded substrate under reducing conditions to form particles of a platinum metal element on said carbon substrate.
- 2. The method according to claim 1 wherein said carbon substrate has a surface area of about 100 to about 2500 m^2/g .
- 3. The method according to claim 1 wherein said platinum metal complex-loaded substrate is heated at a temperature of about 200° to about 300° C.

- 4. The method according to claim 1 wherein said anionic complex is a halo or halohydroxoaquo complex.
- 5. The method according to claim 1 wherein said cationic complex comprises one or more nitrogen atoms contained in a monodentate, bidentate or tridentate ligand.
- 6. A method for preparing particles of a platinum metal element on a carbon substrate that comprises the steps of:
- (a) contacting a carbon substrate having a surface area of about 100 to about 2500 m²/g with an aqueous solution of a dissolved platinum metal element complex present at a pH value of about 2 to about 4 where said platinum metal element is present as an anionic complex, whereby use of a carbon substrate having a higher PZC value at said pH values provides greater adsorption of said platinum metal element complex than does use of a substrate having a lower PZC value;
- (b) maintaining said contact at said pH value for a time period sufficient for said platinum metal element complex to adsorb onto said substrate to form a platinum metal complex-loaded substrate;
- (c) heating said platinum metal complexloaded substrate under reducing conditions at a temperature of about 200° to about 300° C to form particles of a platinum metal element on said carbon substrate.

- 7. The method according to claim 6 wherein said anionic complex is a halo or halohydroxoaquo complex.
- 8. The method according to claim 7 wherein said halo or haloaquo complex is a chloro or chlorohydroxoaquo complex.
- 9. The method according to claim 8 wherein said chloro or chlorohydroxoaquo complex is selected from the group consisting of $PtCl_4^{2-}$, $PtCl_6^{2-}$, $PtCl_5^{2-}$, $PdCl_4^{2-}$, $[RhCl_4(H_2O)_2]^-$, $[RhCl_5(H_2O)]^{2-}$, $[IrCl_5(H_2O)]^-$, $[RhCl_6^{3-}$, $IrCl_6^{3-}$, $OsCl_6^{2-}$ and $[RuCl_4(H_2O)_2]^-$.
- 10. A method for preparing particles of a platinum metal element on a carbon substrate that comprises the steps of:
- (a) contacting a carbon substrate having a surface area of about 100 to about 2500 m²/g with an aqueous solution of a dissolved platinum metal element complex present as a cationic complex at a pH value of about 10.5 to about 13, whereby use of a carbon substrate having a lower PZC at said pH value provides greater adsorption of said platinum metal element complex than does use of a substrate having a higher PZC;
- (b) maintaining said contact at said pH value for a time period sufficient for said platinum metal element complex to adsorb onto said substrate to form a platinum metal complex-loaded substrate;
- (c) heating said platinum metal complexloaded substrate under reducing conditions at a temperature of about 200° to about 300° C to form

particles of a platinum metal element on said carbon substrate.

- 11. The method according to claim 10 wherein said cationic complexes includes one or more nitrogen atoms contained in a monodentate, bidentate or tridentate ligand, or said one or more nitrogen atoms and water from an amminoaquo complex.
- 12. The method according to claim 11 wherein said cationic complex containing a monodentate, bidentate or tridentate ligand is an ammine, pyridine ,ethylenediamine, 1,3-propanediamine, 1,10-phenanthroline, 2,2'-bypyridine or diethylenetriamine ligand.
- wherein said ammine-containing cationic complex is selected from the group consisting of $\operatorname{Ru}(NH_3)_5(H_2O)]^{2+}$, $[\operatorname{Ru}(NH_3)_5(H_2O)]^{3+}$, $[\operatorname{Ru}(bipy)_3]^{2+}$, $[\operatorname{Os}(bipy)_3]^{2+}$, $\operatorname{Rh}(NH_3)_6^{3+}$, $\operatorname{Ir}(NH_3)_6^{3+}$, $\operatorname{Pd}(NH_3)_4^{2+}$, $\operatorname{Pt}(en)^{2+}$, $\operatorname{Pd}(py)_2^{2+}$, and $[\operatorname{Pt}(en)_2]^{2+}$.